

Walking the tightrope with an e-portfolio

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ARTICLE



Walking the tightrope with an e-portfolio: imbalance between support and autonomy hampers self-directed learning

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ABSTRACT

Teacher coaching is essential to support self-directed learning, but requires a lot of time and energy. This mixed-methods study investigated the effects of using an e-portfolio with a self-coaching protocol and limited teacher coaching on the development of self-directed learning skills and motivation. With regard to self-directed learning, students' overestimation of performance on learning tasks grew over time, while their ability to formulate points for improvement did not change significantly. With regard to motivation, students' controlled (i.e. largely extrinsic) motivation increased while their autonomous (i.e. largely intrinsic) motivation decreased. Thematic analysis of interviews demonstrated students needed more support and feedback from their teacher. The use of suboptimal cues for performance assessment and an imperfect balance between autonomy and support hampered self-directed learning and motivation. We recommend providing just-in-time feedback about performance on learning tasks and giving students some autonomy over the choice of learning tasks, to enhance reflection and motivation.

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1. Introduction

Over the last decade, the composition of senior vocational education and training (VET) in the Netherlands has adapted to meet the demands of a changing workplace (e.g. the introduction of competency-based education). Typically, Dutch VET programmes are aimed at training students to become professionals in specific areas including technology, economics, and health care. To respond to varying demands of the workplace, Dutch VET is differentiated into four levels that gradually become more demanding and complex. Depending on the level, these programmes may take anywhere between six months and four years (for extensive information about the Dutch education system see Nuffic 2015).

Among others, the change to competency-based education requires students to assume more control and responsibility over their learning process (Jossberger et al. 2010). Giving students more control over the learning process is thought to be advantageous for them. More control is associated with a heightened degree of learner autonomy, which is an important component of intrinsic motivation for learning (Ryan and Deci 2000).

However, students in various contexts tend to lack well-developed self-directed learning (SDL) skills, essential to effectively controlling their learning. Among others, they tend to utilise sub-optimal cues for performance assessment (i.e. indicators of actual performance Koriat 2007), hold overly positive views of their own performance (e.g. Foster et al. 2016), and fall prey to self-serving biases in self-evaluations (e.g. Dunning, Meyerowitz, and Holzberg 1989). In order to successfully complete Dutch VET programmes that offer a high degree of learner control, it is essential that students develop adequate SDL skills.

SDL has been defined in many different ways, but most definitions share common elements that include self-assessment of performance, identification of learning needs and subsequent formulation of points for improvement (Pfls), and selection of learning tasks (e.g. Ziegler, Stoeger, and Grassinger 2011; Zimmerman 2008). Much like the acquisition of domain-specific skills, students should be supported and guided when they acquire SDL skills. Without training, students exhibit problems with assessing their performance (e. g. Zmary, Rawson, and Dunlosky 2016), formulate non-specific goals for study sessions (McCardle et al. 2017), and are not proficient at choosing learning tasks that match their learning needs (Corbalan, Kester, and van Merriënboer 2009). It is thus evident that students should only gradually assume responsibility over their own learning process.

The teacher has an important coaching role in helping students gradually assume more responsibility over their own learning. Teacher coaching should provide students with feed up, feed back, and feed forward about their learning (Hattie and Timperley 2007). This entails helping students to answer the following questions: 'Where am I going?' (feed up), 'How am I going?' (feed back), and 'Where to next?' (feed forward). To help students gradually become more responsible for acquiring SDL skills it is imperative that teachers' advice gradually becomes less detailed. This is a process referred to as 'second-order scaffolding' (van Merriënboer and Kirschner 2013). For example, teachers can help students self-assess their performance by providing them with very concrete performance standards. Over time teacher coaching promotes students' responsibility by providing increasingly abstract performance standards.

Kicken Brand, Gruwel, and van Merriënboer (2008) suggest that teacher coaching can be assisted by using an electronic development portfolio that can facilitate a gradual shift in responsibility for learning with built-in features that support learners' self-directedness. An electronic development portfolio facilitates self-assessment of performance on learning tasks by automatically offering

performance standards and information on the student's current level of performance. It facilitates identification of learning needs and formulation of Pfls by offering advice on how to formulate them realistically. Finally, the portfolio helps students choose suitable learning tasks, for example by restricting the number of learning tasks they can choose from. As goes with teacher coaching, an electronic development portfolio promotes students' responsibility over their learning by gradually diminishing the detail of the provided information.

Indeed, the use of electronic development portfolios has been associated with positive outcomes for both the development of students' SDL skills as well as their motivation to learn (e.g. Abrami et al. 2013; Ziegler and Moeller 2012). This is not to say that effective use is easily attained. In fact, various reviews demonstrate that a variety of factors influence the effectiveness of portfolio use (e.g. Buckley et al. 2009; Tochel et al. 2009; Van Tartwijk et al. 2007). Research reviews state that teachers should assume a facilitative role when supporting students' development of SDL skills, which can be difficult when they are used to a more directive role (Chau and Cheng 2010). Furthermore, portfolio use should not be casual, there should be a driving force (e.g. an assessment status) that inspires students to take the portfolio seriously (Driessen et al. 2005). While a certain degree of structure is needed to support the student, over-structuration should be avoided (Van Tartwijk and Driessen 2009). Perhaps most evident from the literature is the persistent finding that aforementioned teacher coaching is of paramount importance to effective reflective learning with an e-portfolio (Dekker et al. 2009; McMullan 2008; Nothnagle et al. 2010).

While teacher coaching is crucial to effective SDL with an e-portfolio, it is a time-consuming process and therefore not always possible. Beckers, Dolmans, and Van Merriënboer (2016b) suggest substituting a portion of teacher coaching with student self-coaching, so that teachers' workload is significantly reduced, while students' development of SDL skills continues to be supported adequately. To do so, Beckers, Dolmans, and Van Merriënboer (2016b) have incorporated a student self-coaching protocol (i.e. a set of reflective questions that are routinely asked by teachers during coaching sessions) into an e-portfolio (e.g. 'How can you improve your performance on this learning task?'). As such, a part of the reflective work is already done before the student goes to the coaching session with his teacher.

Results of the Beckers, Dolmans, and Van Merriënboer (2016b) study demonstrated that it was indeed possible to foster positive effects on students' development of SDL skills and motivation for learning, while using an electronic development portfolio with reduced teacher coaching and student self-coaching. Over time, students that used the portfolio in this study more accurately self-assessed their performance on learning tasks and formulated higher quality Pfls. Additionally, students using the portfolio were more intrinsically motivated to learn than their fellow students who did not use the portfolio. To help alleviate teachers' workload and generate time for other teaching activities

(e.g. specialist coaching that cannot be automated) it is important to see if the positive effects of the Beckers, Dolmans, and Van Merriënboer (2016b) study hold true across different settings. Furthermore this study answers the call for an increase in replication studies (Leppink and Pérez-Fuster 2017). Moreover, this study aims to understand and explain the changes in self-assessment of performance, the quality of formulated Pfls, and the change in motivation, so future interventions may enhance these effects even further.

Therefore, we aim to answer the following research questions:

- (1) What are the effects of using an electronic development portfolio with a student self-coaching protocol and limited teacher coaching in the context of Dutch VET on the development of SDL skills and motivation for learning?
- (2) How can these effects be explained by students' perceptions of the portfolio's ability to help them self-direct their learning?

We expect students to show development of their SDL skills (i.e. we expect students' self-assessments to become more accurate and the quality of their Pfls to increase). Furthermore, we expect students to become more intrinsically motivated over the intervention period.

2. Method

Forty-seven students participated in this study. The sample included 32 males and 15 females with a mean age of 17.3 years ($SD = 1.5$). These were all Dutch VET students in the Western part of the Netherlands. There were 17 first-year 'Retail entrepreneur' students, 13 first-year 'Retail manager' students, 10 second-year 'Retail entrepreneur' students, and 7 second-year 'Retail manager' students. Four of the students' own teachers participated in this study.

2.1. Materials

2.1.1. *Perflect*

An electronic development portfolio (PERFLECT; Beckers, Dolmans, and Van Merriënboer 2016a) was used to help students self-assess their performance on learning tasks, formulate Pfls, and select future learning tasks. PERFLECT was designed specifically to provide second-order scaffolds. Its functionalities offer support for self-assessments of performance, formulation of Pfls, and selection of future learning tasks. Moreover, PERFLECT is aimed at providing important information overviews that help teachers give more specific feed up, feed back and feed forward in teacher coaching sessions. Finally, PERFLECT relieves teacher workload by carrying out some administrative processes (e.g. PERFLECT automatically integrates students' self-assessment scores with teacher-assessment scores).

Self-assessment of performance is a four-step process in PERFLECT. First, students are asked to fill out details about the learning task. Second, students select assessment criteria for the learning task that they deem relevant. Third, students score these assessment criteria with either *U* (unsatisfactory), *Q* (questionable), *S* (satisfactory), *W* (well), or *N/A* (not applicable). Finally, students are asked to answer questions prompting reflection (e.g. 'What parts of the learning task still need improvement?').

Formulation of Pfls is integrated in the self-assessment as one of the questions that prompt reflection ('Can you formulate a learning goal to improve your performance on this learning task?'). PERFLECT automatically saves the answer to this question for review later on.

Support of selection for future learning tasks is also an integrated part of the self-assessment. Two reflective questions help students determine the difficulty and level of support that is appropriate for future learning tasks (i.e. 'Can you now complete a more difficult learning task?' and 'Would you like to complete the next learning task with our without support?').

2.1.2. *Teacher coaching protocol*

A teacher coaching protocol was used to ensure that all coaching sessions with the teacher adhered to the same basic structure. Like PERFLECT, the coaching protocol was designed to support self-assessment, formulation of Pfls, and selection of future learning tasks. Three questions in the protocol are aimed at supporting self-assessment of performance on learning tasks (e.g. 'Do you agree with the student's self-assessment scores?'). Four questions in the teacher coaching protocol are aimed at supporting formulation of Pfls (e.g. 'Are the formulated Pfls realistic?'). Finally, two questions in the teacher coaching protocol are aimed at supporting selection of future learning tasks (e.g. 'Is the student ready to complete a more difficult learning task?').

2.1.3. *Learning tasks*

In cooperation with the teachers in the study we developed 11 learning tasks to help students master the topic of sales activities and to provide them with the opportunity to self-assess their performance. These learning tasks all consisted of dilemmas (e.g. providing feedback to aggressive sales employees) that students may encounter in practice. They were asked to provide solutions for the practical dilemmas. To help the students with the learning tasks, support in the form of prompts was offered (e.g. 'It is important to provide feedback based on observed behaviour, not based on personal characteristics'). To help students develop their self-assessment skills, support was also offered in the form of a pre-selection of relevant assessment criteria. Over the learning tasks this support gradually faded.

2.2. Measurement instruments

2.2.1. SRQ-A

To measure students' level of motivation for learning we used an adapted version of the Academic Self-Regulation Questionnaire (SRQ-A; Vansteenkiste et al. 2009). The questionnaire consists of four sub-scales. The first sub-scale measures intrinsic motivation (four items, $\alpha = .89$), a type of motivation that is fully autonomous. The second sub-scale measures identified regulation ($\alpha = .79$) an autonomous form of motivation in which external values have been largely internalised. The third sub-scale measures introjected regulation ($\alpha = .69$), which is a largely controlled type of motivation with some aspects of internalisation. Finally, the fourth sub-scale measures external regulation ($\alpha = .77$), the most controlled type of motivation. One item was removed from the introjected regulation sub-scale because it displayed a negative item-total correlation. Students were asked to indicate their level of agreement with the presented items in the sub-scales. All answers were recorded on a 5-point Likert scale, ranging from *Not at all important* (1) to *Very important* (5).

2.2.2. Evaluation questionnaire

Students' perceptions about various aspects of working with PERFLECT were measured with an evaluation questionnaire. Students' perceptions about PERFLECT's and their teacher's ability to help them improve self-assessment of performance were measured with six items (e.g. 'Answering questions by myself in PERFLECT has taught me how to self-assess myself'). Students' perceptions about PERFLECT's and the teacher's ability to help students formulate Pfls were measured with two items (e.g. 'The coaching session with my teacher stimulated me to formulate Pfls'). Two items were also used, with regard to measuring students' perceptions about PERFLECT and the teacher's ability to help students select future learning tasks (e.g. 'Answering questions by myself in PERFLECT has stimulated me to think about what I should work on with new learning tasks'). Motivation for learning with PERFLECT and during the coaching sessions with the teacher was measured with two items as well (e.g. 'The coaching sessions with my teacher improve my effort and motivation to learn'). Perceptions about PERFLECT's and the teacher's ability to help students gain domain-specific knowledge and skills were measured by four items (e.g. 'Answering questions by myself in PERFLECT has helped me prepare for the domain-specific test of sales activities'). Finally, three items measured students' perceptions about PERFLECT's usability and utility (e.g. 'I thought PERFLECT was user-friendly'). All answers were recorded on a 5-point Likert scale, ranging from *I fully disagree* (1), to *I fully agree* (5).

2.2.3. Domain-specific test

A domain-specific test was used to measure the level of knowledge on the topic of sales activities. The test consisted of 8 multiple choice questions and 22 open-ended questions. Students could obtain a score between 1–10, where a score of

1 is considered to be very poor, a score of 10 is considered to be excellent (i.e. a test with absolutely no errors) and a 5.5 is the minimum passing grade.

2.2.4. *Self-assessments and teacher assessments*

All self-assessments and teacher's assessments were saved in PERFLECT. To measure quality of students' self-assessments we compared them with teachers' assessments on the same learning tasks. On these joint assessments we measured how often students and teachers selected the same criteria for performance assessment and how often students and teachers scored criteria similarly. To see if there was improvement over time (i.e. more agreement on what criteria to select and how to score them) we compared the first half of the assessments with the second half of the assessments.

2.2.5. *Formulated Pfls*

All Pfls were analysed to see to what degree they contained an improvement goal, a method of improvement, and a condition under which the improvement should take place. The presence of a quality element (i.e. a goal, a method, or a condition) yielded one quality point per element. As such the total quality score ranges from 0 (no elements present in the Pfl) to 3 (all elements present in the Pfl). For example, the Pfl: 'I need to help more customers (goal) during busy hours (condition)', yields two quality points, because it contains a goal and a condition, but not a method. Each Pfl was independently coded by two members of the research team (inter-rater-reliability $\kappa = .85$). To see if there was improvement in the quality of formulated Pfls we compared the first half of formulated Pfls with the second half of Pfls.

2.2.6. *Observations of coaching sessions*

Coaching sessions were observed by JB, who paid attention to any behaviours or conversations targeting motivation or SDL (i.e. self-assessment of performance, formulations of Pfls, and selection of future learning tasks). Observations were only recorded if the behaviour or conversation went beyond the act of simply being engaged in SDL. Simply being engaged in SDL was not recorded, as it offers little informative value. For example, if JB observed teacher and student were formulating Pfls, this was not recorded, as this is simply engaging in SDL. However, if JB observed that a teacher was explaining how a student should formulate a Pfl, this observation was recorded, as this goes beyond the act of simply being engaged in SDL.

2.2.7. *Student interviews*

Focus group participants were randomly selected from all students that partook in the study. Four focus groups were conducted with a total of 19 students. Research assistants with interviewing experience facilitated the focus group discussion while JB took notes. Students were asked open-

ended questions about how they perceived PERFLECT to help them with SDL (e.g., 'How did answering questions by yourself in PERFLECT help you to learn from the learning task?'). Data from the evaluation questionnaire were already available at the time of the interview and used as input (e.g. 'Many of you think that the self-reflection in PERFLECT could be improved. How would you suggest that it should be improved?')

All interviews were recorded and transcribed verbatim. The transcripts were entered into and analysed with qualitative data analysis software (QDA miner 1.5 lite). To analyse the data from focus groups we used thematic analysis with elements of grounded theory (i.e. open coding and axial coding, Strauss and Corbin 1990). We started the analysis with open coding (i.e. primary coding that describes raw phenomena). Both JB and MK coded the first interview in full. Subsequently, discrepancies in coding were discussed and consensus was reached. MK coded the remaining three interviews. Ensuing, JB used axial coding (i.e. secondary coding aimed at creating connections between open codes) in an iterative process to create initial categories from all open codes. The axial codes were discussed with DD and adapted were needed until both researchers agreed on content. JB combined the final version of the axial codes into themes and a thematic map. The thematic map and themes were discussed among JB, DD, and JvM and adapted until consensus was reached.

2.3. Design

We employed a mixed-method sequential explanatory design (Ivankova, Creswell, and Stick 2006). This design is best suitable to answer our research questions. On the one hand, we want to research whether or not e-portfolio use with limited teacher coaching and a self-coaching protocol has a positive effect on motivation and SDL. This is clearly a quantitative question. On the other hand we aim to understand what exactly constitutes this effect and how this effect is influenced through participant perceptions. These perceptions provide depth to the quantitative results. The quantitative and qualitative data each have their own role. Moreover, their roles are attuned to each other. Both data sources have their intrinsic value, but in conjunction the sum is greater than the whole of its parts. This is only possible with this specific design. This specific kind of design involves collection and analysis of data over consecutive phases (i.e. quantitative and a qualitative phases). Data that are collected and analysed in initial phases are subsequently enriched with data collected in later phases. Our study consisted of two phases. In the first phase we gathered quantitative data during the intervention (i.e. data in the portfolio) and shortly after (i.e. the SRQ-A and the evaluation questionnaire) which we used to establish preliminary conclusions. In the second phase these preliminary conclusions were explained with qualitative data (i.e. the student interviews) that were gathered shortly after the intervention.

2.4. Procedure

Three of the four teachers in this study had previously worked with PERFLECT. The other teacher was trained informally by the experienced teachers. To promote ownership among the participating teachers, they instructed students about how to work with PERFLECT themselves (instead of the researchers) and they also administered the pre-test (consisting of the SRQ-A) in the first week of the intervention. The intervention consisted of an 11-week period in which students received theoretical instruction about sales activities, completed learning tasks about sales activities under supervision, self-assessed their performance on these learning tasks, and received additional teacher coaching.

The intervention followed a weekly routine. Two hours were reserved for theoretical instruction that was aimed at supporting successful completion of learning tasks. Two more hours were reserved for self-assessment of their performance on learning tasks with PERFLECT. These two hours were supervised by a teacher. It was during these two hours that students were called from their class for a 15-minute additional coaching session once every two weeks (i.e. on a turn-by-turn basis). In these sessions, teachers used the teacher coaching protocol to discuss students' skills with regard to self-assessment, formulation of Pfls, and learning task selection. Furthermore, discrepancies and similarities between the student's self-assessment and the teacher assessment were also discussed. After the coaching session the teachers provided feedback to the students. At the end of the 11-week period students were asked to fill-out the post-test (consisting of the SRQ-A and the evaluation questionnaire).

3. Results

In the following sections, we present qualitative scores of students' self-reported motivation levels (SRQ-A) and students' scores on a domain-specific test. We analyse students' development of SDL skills by presenting students' self-assessment accuracy and the quality of their formulated Pfls over time. We present thematic analysis on student interviews and observations of coaching sessions, that attempt to understand the quantitative findings by exploring how PERFLECT with limited teacher coaching and a student self-coaching protocol influences the development of skills for SDL.

3.1. SRQ-A

Table 1 presents means and standard deviations for the SRQ-A sub-scales of Intrinsic Motivation, Identified Regulation, Introjected Regulation, and External Regulation for the pre-test and the post-test. Mean scores on the Intrinsic Motivation sub-scale ($\alpha = .89$) are 14.84 for the pre-test and 13.55 for the post-test, with a scale maximum of 20 (sum of 4 items, scale 1–5). Mean scores on the

Table 1. Means, standard deviations, and mean differences between pre-test and post-test for the SRQ-A subscales of intrinsic motivation, identified regulation, introjected regulation, and external regulation on the pre-test and post-test.

Sub-scale	Pre-test (A)		Post-test (B)		Mean difference (A-B)
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Intrinsic motivation	14.84	2.88	13.55	2.79	1.29
Identified regulation	14.94	2.69	13.41	2.64	1.53 ^a
Introjected regulation	5.64	2.20	8.35	2.89	-2.71 ^b
External regulation	5.81	2.85	9.55	3.80	-3.74 ^b

Note. Intrinsic Motivation scale maximum = 20, scale 1–5, Identified Regulation scale maximum = 20, scale 1–5, Introjected Regulation scale maximum = 15, scale 1–5, External Regulation, scale maximum = 20, scale 1–5.

^aSignificant at the $p < .05$ level.

^bSignificant at the $p < .005$ level.

Identified Regulation sub-scale ($\alpha = .79$) are 14.94 for the pre-test and 13.41 for the post-test, with a scale maximum of 20 (sum of 4 items, scale 1–5). Mean scores on the Introjected Regulation sub-scale ($\alpha = .85$) are 5.64 for the pre-test and 8.35 for the post-test, with a scale maximum of 15 (sum of 3 items, scale 1–5). Finally, mean scores on the External Regulation sub-scale ($\alpha = .90$) are 5.81 for the pre-test and 9.55 for the post-test, with a scale maximum of 20 (sum of 4 items, scale 1–5).

Paired-samples *t*-tests demonstrate that, between pre-test and post-test, there was a significant increase in scores on External Regulation ($M = -3.74$, $SD = 3.78$), $t(30) = -5.52$, $p = .000$, a significant increase in scores on Introjected Regulation ($M = -2.71$, $SD = 2.82$), $t(30) = -5.35$, $p = .000$, and a significant decrease of scores on Identified Regulation ($M = 1.52$, $SD = 3.43$), $t(30) = 2.46$, $p = .020$. There was no significant difference between scores on pre-test and post-test on Intrinsic Motivation ($M = 1.29$, $SD = 3.71$), $t(30) = 1.94$, $p = .062$.

3.2. Evaluation questionnaire

In Table 2, we present students' mean evaluation scores of various aspects of working with PERFLECT. We present scores pertaining to PERFLECT's and teachers' ability to help improve self-assessment of performance ($M = 2.6$, $SD = 0.8$, $\alpha = .90$), formulation of Pfls ($M = 2.5$, $SD = 0.8$, $\alpha = .77$), learning-task selection ($M = 2.6$, $SD = 0.8$, $\alpha = .77$), motivation for learning ($M = 2.4$, $SD = 1.0$, $\alpha = .90$),

Table 2. Students' mean evaluation scores and standard deviations on various aspects of working with PERFLECT including: SDL, motivation, domain-specific skills, and usability and utility.

Evaluation aspect	Score (items)	
	<i>M</i> (1–5)	<i>SD</i>
Self-assessment of performance	2.6	0.8
Formulation of Pfls	2.5	0.8
Learning-task selection	2.6	0.8
Motivation for learning	2.4	1.0
Domain-specific skills	2.5	0.7
Usability and utility	2.4	0.8

Note. The evaluation questionnaire was filled out by 37 participants.

and domain-specific skills ($M = 2.5$, $SD = 0.7$, $\alpha = .78$). We also present scores pertaining to PERFLECT's usability and utility ($M = 2.4$, $SD = 0.8$, $\alpha = .74$). The evaluation scores reflect a slight dissatisfaction with all aspects.

3.3. Domain-specific test

A total of 35 students out of 47 completed the domain-specific test and obtained an average score of 3.9 ($SD = 1.0$) out of 10. Only 2 students passed the test (i.e. obtained a score higher than or equal to 5.5), while 33 students failed (i.e. obtained a score lower than 5.5).

3.4. Self-assessments and teacher assessments

On average, students self-assessed about six learning tasks ($M = 5.9$, $SD = 3.0$). Their teachers assessed between three and four learning tasks per student ($M = 3.6$, $SD = 1.7$). In total, 109 learning tasks were assessed by both teachers and students (please note that some learning tasks were assessed by teachers but not by students and vice versa). When divided over two periods, the first period contains 52 joint assessments, whereas the second period contains 57 joint assessments.

Table 3 displays agreement percentages between students' self-assessments and those of their teachers on scored performance criteria for both time periods. Please note that percentages were rounded, not every row and column will add up to their respective row and column totals.

In Period 1, overestimation (i.e. the sum of the underlined numbers *below* the bold italic diagonal in Table 3) constituted 10% of the scored criteria, this was 21% for Period 2. This implies a significant increase of 11 percentage

Table 3. Students' self-assessment scores versus teacher assessment scores in Period 1s and 2 (as percentage of total).

		Teacher score %					
		NS	U	Q	S	W	Total
Period 1							
Student score %	NS	22	1	2	3	0	29
	U	1	0	0	0	0	2
	Q	18	0	1	3	0	22
	S	21	1	4	7	0	32
	W	11	1	2	2	0	15
Total		73	4	9	15	0	100 ^a
Period 2							
Student score %	NS	9	3	6	5	0	22
	U	2	0	1	0	0	2
	Q	17	1	4	3	0	24
	S	20	4	9	6	0	38
	W	6	1	4	2	0	13
Total		54	9	23	15	0	100 ^b

Note. NS, not scored; U = unsatisfactory; Q = questionable; S = satisfactory; W = well. Please note that percentile scores are rounded.

^a100% = 449 criteria.

^b100% = 532 criteria.

points in performance overestimation occurrences, $\chi^2 (1, 981) = 22.527$, $p = .000$. In Period 1, both students and teachers scored criteria as *Not Applicable* or did not score them at all in 22% of the cases (i.e. the bold italic number in Table 3). In Period 2, they selected *Not Applicable* or did not score criteria at all in only 9% of the cases. This is a significant decrease of 13 percentage points, $\chi^2 (1, 981) = 31.154$, $p = .000$. In Period 1, students and teachers agreed on criteria scores in only 8% of the cases (i.e. the bold-only diagonal in Table 3). In Period 2, they agreed on criteria scores in 10% of the cases. The difference of 2 percentage points between Period 1 and Period 2 is not significant, $\chi^2 (1, 981) = .920$, $p = .337$. Students and teachers selected different criteria to assess the same learning tasks (i.e. all non-bold italic numbers in Table 3) in 57% of the cases in Period 1. This was 59% for Period 2, a non-significant change, $\chi^2 (1, 981) = .002$, $p = .968$. Finally, underestimation of performance (i.e. the sum of the underlined numbers *above* the bold italic diagonal in Table 3) occurs in 3% of the cases in Period 1. This was 4% in period 2, a non-significant change, $\chi^2 (1, 981) = .001$, $p = .975$.

3.5. Formulated Pfls

Students formulated an average of six Pfls during the intervention ($M = 6.0$, $SD = 3.0$); however, not all of these were meaningful (i.e. some of these Pfls neither contained goals, nor methods, nor conditions). Examples of such Pfls are: 'No', 'I cannot', and 'Not applicable'. After subtracting all meaningless Pfls, students formulated a little less than four Pfls on average ($M = 3.8$, $SD = 2.5$). This amounts to about one meaningful PFI for every two learning tasks. Most of these were formulated rather succinctly (e.g. 'handle complaints better' or 'check up on procedure').

Table 4 presents repeated measures of the quality and composition of the meaningful Pfls. For each trial (i.e. for each subsequent point in time) we report the number of formulated Pfls, the percentage of Pfls that contain goals, methods, and conditions, and the average quality score of Pfls. Trials had to contain more

Table 4. The quality of students' formulated Pfls over time/trials.

Trial	Meaningful Pfls formulated	Pfl includes goal	Pfl includes method	Pfl includes condition	Pfl quality score	
No.	N	%	%	%	<i>M</i> (1–3)	<i>SD</i>
1	33	42	58	0	1.00	0.00
2	25	40	56	16	1.12	0.33
3	26	42	58	12	1.08	0.27
4	23	30	65	9	1.04	0.21
5	15	33	67	7	1.07	0.26
6	13	38	62	8	1.00	0.00
7	10	40	60	10	1.10	0.32
8	10	50	60	20	1.30	0.48
9	6	33	50	33	1.17	0.41
10	6	50	50	0	1.00	0.00

than one Pfl to be considered as such. Most Pfls include a method (59%) or a goal (40%); however, only a small number of Pfls includes a condition (10%).

A paired samples *t*-test demonstrates that the quality of Pfls does not differ significantly between trials 1–5 and trials 6–10, $t(24) = -0.44$, $p = .664$.

3.6. *Observations of coaching sessions*

In total, 36 coaching sessions were observed by JB. Table 5 lists all observations pertaining to motivation, self-assessment of performance on learning tasks, formulation of Pfls, and selection of future learning tasks.

Looking at motivation, three things stand out. Firstly, students tend to discard the relevance of learning tasks that do not closely match their daily practice. Secondly, whenever teachers try to motivate students they often to do so by referring to an upcoming test. Thirdly, students do not feel challenged. Looking at self-assessment of performance on learning tasks, it becomes clear that students have a lot of trouble with hypothetical situations. They display problems reflecting on situations if they lack direct experience with them. This is also apparent in students' comprehension of performance criteria, which are often formulated too broad for their liking. When teachers try to help students they often to have them imagine situations that resemble closely to situations that they have actually already been in. With regard to formulation of Pfls two things stand out. Firstly, students formulate rather broad Pfls. Secondly, teachers recognise this and try to help students formulate focused Pfls, mostly by directing them to the SMART method. Finally, only in a few occasions selection of future learning tasks was discussed beyond the very basics. These instances are too little and too far between to be able to determine any pattern.

3.7. *Student interviews*

Thematic analysis of student interviews revealed four main themes in student discourse about working with PERFLECT. These themes include SDL conceptions, need for support and feedback, usability and utility, and motivation for learning. Forthcoming, we will describe the identified themes in more detail.

All themes and sub-themes are displayed in Figure 1. Theme 1, SDL conceptions is represented by the sub-themes within the continuous oval-shaped line. Theme 2, need for support and feedback is comprised by all sub-themes within the double-lined oval shape. Theme 3, usability and utility, contains all sub-themes within the dashed oval-shaped line. Finally, theme 4, motivation for learning is built up from all sub-themes within the double-lined dashed oval shape. Please note that sub-themes are all represented by grey circles. The size of these circles communicates the relative dominance of the sub-themes within student discourse.

Table 5. Observations of behaviour and language pertaining to motivation and SDL during coaching sessions.

Session	Motivation	Self-assessment of performance	Formulation of Pfls	Selection of future learning tasks
Session 1	Student says: 'But in real life? How is this relevant?' and: 'Sure, if my boss requires me to, I will do it.'	Student does not know how to self-assess performance on learning tasks in PERFECT	–	–
Session 2	–	Student did not assess learning-task performance from her own perspective (i.e. the entrepreneur's perspective), but from the perspective of the client	–	–
Session 3	Student says: 'None of these learning tasks challenge me.'	Teacher challenges student to reflect on his skills on a more abstract level	–	–
Session 4	Student claims to not be challenged by learnings tasks. Teacher says: 'I notice I'm not enjoying this activity.' [There were technical issues during this coaching session]	–	–	–
Session 5	–	–	The teacher shortly discusses what is wrong with the Pfl that is currently formulated by the student	–
Session 6	Student would like it if better studying behaviour would lead to improved study results	–	There is a short, shallow discussion about the formulated point for improvement	–
Session 7	–	Student did not self-assess learning-task performance, because no model with correct answers was available. This model is thought to be essential for meaningful self-assessment of learning-task performance	–	–
Session 8	–	Student did not select correct criteria for performance assessment. Student claims problems arose because most performance criteria were formulated way too broadly. As such he did not see relevance to the particular learning task.	–	–

(Continued)

Table 5. (Continued).

Session	Motivation	Self-assessment of performance	Formulation of Pfls	Selection of future learning tasks
Session 9	-	Student and teacher agree on assessment of learning-task performance	-	Teacher asks student which learning task would be suitable as a next step. No subsequent further discussion ensues.
Session 10			Teacher asks student: 'Did you have any Pfls?' - 'No not really, but now that you've asked me, yeah I do'	
Session 11	-	Student misinterpreted aspects of the learning task, which led him to select incorrect criteria. Student consequently scored his performance on learning tasks 'Questionable'. He did so because he had not previously performed the learning task. As such his performance would have to be questionable by default, the student claims	-	-
Session 12	Student is motivated to improve specificity of her answers to obtain a high test score	Student says: 'How can I assess my performance during a robbery, when I've never been in an <i>actual</i> robbery?' [The learning task was about a robbery] Teacher says: 'Well, how can you make this practical?'	-	-
Session 13	-	-	In-depth discussion of desired performance on learning task. Result of discussion is integrated into Pfl	-
Session 14	-	Student and teacher have a discussion about criteria for performance assessment. Teacher explains that criteria can be interpreted on several levels of abstraction.	Student and teacher have a discussion about relevance of Pfl.	-

(Continued)

Table 5. (Continued).

Session	Motivation	Self-assessment of performance	Formulation of Pfls	Selection of future learning tasks
Session 15	-	Student does not understand what criteria for performance assessment mean. Teacher tries to elucidate. Teacher directs student towards discrepancy between student's judgement and teacher's judgement. Self-assessment is hindered by the fact that student does not accept premise to the learning task: 'There is no way that anybody would ever rob my department store'	-	There is a discussion on the broader picture. Teacher explains that student will be able to do her job better if she knows how to handle robberies by compliance to branch rules instead of physical confrontations.
Session 16	-	Student was not able to self-assess performance on learning task, because of technical issues with PERFLECT. Teacher and student engage in cooperative assessment. Teacher gradually lets student assume responsibility: 'This part you have to assess without my help'	-	-
Session 17	-	Teacher advises student to make criteria more concrete by applying them to practical situations.	Teacher points student towards the limited practical relevance of formulated Pfl. 'You want to improve your reading, how would that help when you there's a gun to your head?'	-
Session 18	-	Student says she has trouble self-assessing her performance on learning tasks because she has never been in an actual robbery: 'I could never know how I would react!'	-	Student finds it very hard to imagine what a more difficult future learning task would look like
Session 19	-	Student did not self-assess his performance on all relevant criteria, only on a subset	-	-

(Continued)



Table 5. (Continued).

Session	Motivation	Self-assessment of performance	Formulation of Pfls	Selection of future learning tasks
Session 20	–	–	Teacher confronts student with badly formulated Pfl: ‘ <i>Just do it better</i> is, of course, a truism’	–
Session 21	–	There is a shallow discussion about self-assessment of performance: ‘Why did you score your performance questionable? – Well, because I did not yet have enough skills’ There is also a shallow discussion about selection of the criteria for self-assessment: ‘Why did you pick this particular criterion? – Because it fit best’	Teacher asks student about Pfls: ‘Did you have any Pfls? – No – But I thought we had agreed you would formulate these using the SMART method?’	–
Session 22	–	Student has self-assessed his performance on the right criteria, but he has overestimated his performance	Student had no Pfls: ‘I kinda didn’t know what to fill out here, so I put nothing’	–
Session 23	–	–	There is a discussion about the use of the SMART method ensuing a poorly formulated Pfl: ‘At this point you have put: <i>Leadership</i> and that is very broad’	–
Session 24	–	Teacher asks student: ‘How do you determine that you have done everything right?’	Teacher asks student if the formulated Pfl: ‘To have more insight’ is formulated using the SMART method	–
Session 25	–	Student has selected correct criteria for self-assessment and provides correct explanation as to why he chose them.	Teacher tells student to formulate Pfls with a narrow scope	Teacher challenges student: ‘You claim to be ready for a more difficult learning task, but is that really the case?’
Session 26	Teacher says to student: ‘You are really looking for a challenge, that is what you keep saying!’	–	–	–
Session 27	Teacher tells student that student he will not obtain any points on the test if he puts an answer there similar to the one on the learning task	–	–	–
Session 28	–	–	–	–

(Continued)



Table 5. (Continued).

Session	Motivation	Self-assessment of performance	Formulation of Pfls	Selection of future learning tasks
Session 29	Teacher attempts to motivate student to integrate more theoretical perspectives into his answers: 'How can you score points on the upcoming test? If you show us that you understand!'	Teacher and student have deep discussion about the meaning of a criterion for performance assessment	–	–
Session 30	–	Teacher tries to help student decide what criterion should be selected for performance assessment: 'Now consider that you were managing employees in this learning task, what criteria would be appropriate?'	–	–
Session 31	–	–	–	Teacher challenges student to think about what the learning task would look like if it were to be more difficult. Student provides a plausible answer. Teacher sees opportunity to talk about the student's professional future beyond the next learning task.
Session 32	Student does not see relationship between learning tasks and theory: 'Right now I'm focused on studying the text book and there is a bunch of stuff in there that is not in any of the learning tasks!'	–	–	–
Session 33	–	Teacher asks student why she only scored her performance on the learning task as questionable? Student answers that in real-life she has not yet encountered the specific skill.	–	–

(Continued)

Table 5. (Continued).

Session	Motivation	Self-assessment of performance	Formulation of Pfls	Selection of future learning tasks
Session 34	-	Teacher tries to challenge student by confrontation: 'You say that you've done everything well in this learning task, but I see a lot of room for improvement'	Student has trouble formulating a Pfl. Teacher tries to help by making it more concrete by comparing two different clothing stores: 'How do you think these stores approach different types of customers? There is a lot of theory about that!'	
Session 35	-	Teacher shows student that he knows how to respond to the situation in the learning task, but also that needs to be able demonstrate it when asked	Teacher and student discuss whether or not the Pfl is formulated using the SMART method	Teacher asks: 'You say you are ready for a more difficult learning task, but you have not shown it to me!'
Session 36	-	-	Teacher and student discuss the SMART method	-

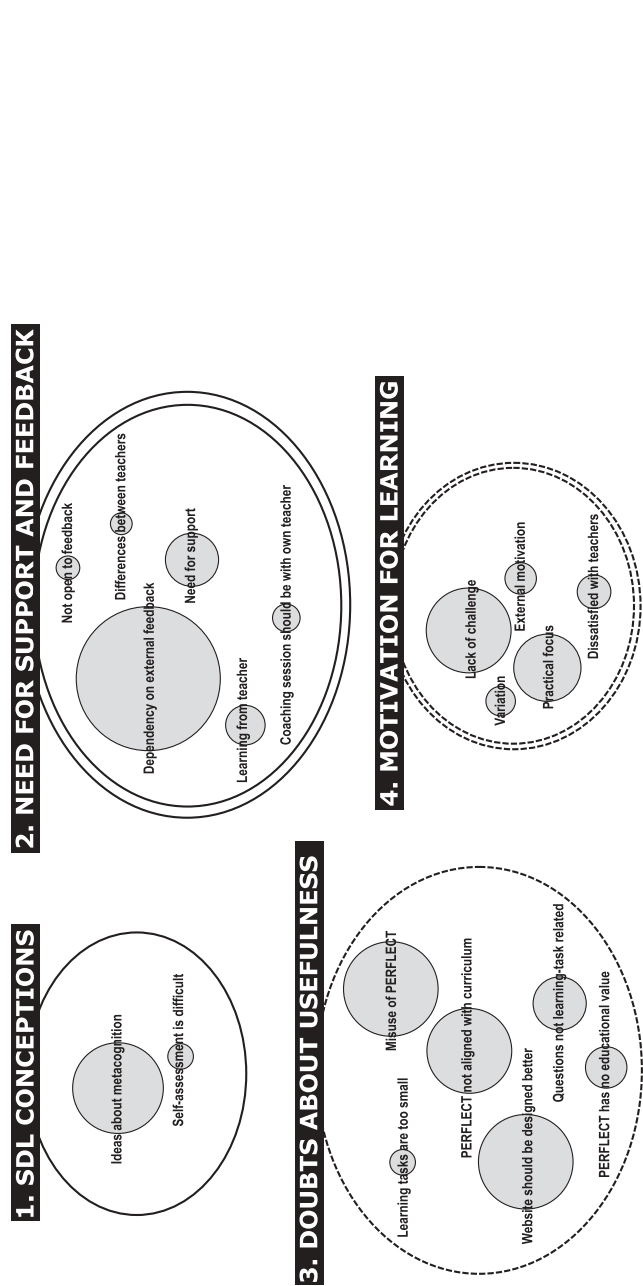


Figure 1. A pictorial representation of identified themes and sub-themes within student discourse about PERFECT's ability to facilitate the development of SDL.

3.7.1. Theme 1. SDL conceptions

Central to this theme are students' conceptions of what SDL entails and whether or not it is useful to self-direct learning altogether. There is strong focus on self-assessment of performance on learning tasks but the theme also touches upon formulation of Pfls. Students find it hard to self-assess their performance and think it is not very useful to do so, they feel information from these assessments is inherently positively biased. They are not inclined to say anything that reflects poorly on them. Students' inclination towards positive judgments of their own performance is captured in the following excerpt:

What went well? I think that everything I do, I do well. (S19)

**** Laughter****

Right? Ultimately, I do... otherwise I would not write it down. (S19)

And how would you like a learning task to be... different then? (INT)

Well, that you just complete the learning task and hand it in. That somebody else just corrects it for you. Because, well, if you correct it yourself... well yeah... you will always do that ehm ... in your own positivity. (S39)

To your own advantage. (S19)

Yes, that. (S39)

When students engage in self-assessment of performance on learning tasks they tend to use suboptimal performance cues to do so, for example: 'Everyone was done in time, so it must be fine. (S27)'

The concept of formulating Pfls is seen as inherently strange. Students do not think it is useful to formulate Pfls because they feel that they have already performed learning tasks to the best of their knowledge and ability. This is not to say that students believe that their performance is always flawless. They just think they are not able to identify what needs to be improved by themselves. This is seen as something only the teacher can do: 'You write down how you think you have done and afterwards you talk with [...] or [...] and only then will it be corrected. Only then you see what you have done wrong' (S33).

3.7.2. Theme 2. Need for support and feedback

Another prevailing topic of conversation was students' need for support and feedback. Students think it is essential to receive feedback from their teachers to *really* know whether or not they are on the right path. A certain insecurity about learning is displayed, which it seems can only be ameliorated by validation of a teacher. Some students even go as far as claiming that without feedback from their teachers it would be impossible to learn at all. The following quote quintessentially captures students' dependency on feedback from their teacher: 'In fact we are just like "Henk" [a person from the learning task], if we... he also

got to hear when he did something wrong. If he did not hear what he did wrong... he would keep on doing the same thing every time right? (S39)'

In a broader sense, students feel they need to be supported more extensively while they develop SDL skills. The following excerpt illustrates students' need for (more) support: 'I was just thrown into the deep end immediately. (S13) And... and... how would you like to see that differently? (INT) Well just eh... feedback about what I am doing. (S13)'

3.7.3. Theme 3. Doubts about usefulness

Discourse in this theme was focused on students' perceptions of PERFLECT's usefulness and usability. As a whole, students do not see much added value in using PERFLECT in their curriculum. They miss certain features in the functional design of the portfolio: 'It is better if the learning tasks would be included in PERFLECT (S19)'. Furthermore, the student self-coaching questions are perceived to be too general to be useful: 'It's just really easy and not about the learning task at all (S28)'. Students' doubts about PERFLECT's usefulness are likely aggravated by their occasional misuse of the portfolio: 'I just put "Well", "Well", "Well", there, when in fact I did not even complete the learning task at all' (S19). Conversely, students feel that if PERFLECT was aligned better to the other parts of the curriculum it might be more useful: 'Well I think in any case... in any case start with PERFLECT a month later. Because then your place of apprenticeship has like a clue of what... what you are like. (S23)'

3.7.4. Theme 4. Motivation for learning

The final theme is concerned with students' motivation for learning. Throughout the interviews students assert that they were only ever really motivated extrinsically for learning by working with PERFLECT. Several obstacles to motivation for learning when working with PERFLECT are identified. Firstly, students perceive some aspects of working with PERFLECT as unchallenging, especially the learning tasks are thought to provoke little thought:

Ehm... yeah I thought it was pretty boring. Haha. (S17)

And what makes it boring? (INT)

Well yeah eh... just the difficulty. In a way it is also quite easy and stuff and as such yeah... then I am not motivated to do it. (S17)

Secondly, working with PERFLECT is perceived to be tedious and monotonous. They perceive the process of self-assessment to be very static, it is always the same: 'I thought that eh... there could be a little more variation. Every time you assess yourself it is the same question over and over. And that gets to be monotonous. (S33)'. Finally, students state that they are highly motivated to learn from tasks that have practical relevance, which in their eyes, PERFLECT

does not have: 'I can complete that learning task, but then I do not know whether I can really do it. (S21) ... There is nothing practical in there, so you can never know. (S40)'

4. Discussion

Working with portfolios is a delicate process that only works under certain terms and conditions (Driessen 2016). The delicacy of this process is reinforced in this sequential mixed-methods explanatory study, where we investigated the effects of using an electronic development portfolio with limited teacher coaching and a student self-coaching protocol on the development of SDL skills and motivation in the context of Dutch VET.

We hypothesised that over the study period students' self-assessments would become more accurate and the quality of students' formulated Pfls would increase. Contrary to what we expected students' self-assessments became *less* accurate; a rise in overconfidence was observed. This overconfidence was most apparent in the discrepancy between students' ideas about their performance and their actual performance. Whereas students attested en masse to the lack of challenge offered by the learning tasks in PERFLECT, the vast majority of them did not pass the related domain-specific test. Overconfidence in own abilities is a well-known phenomenon, especially among low-achieving students (e.g. Kruger and Dunning 1999). However, this does not explain why overconfidence levels *increased* over the intervention period. Qualitative findings suggest that students' repeated exposure to learning tasks that were perceived by them as being too easy, gradually induced a state of over-efficaciousness (i.e. an inflated belief in one's own ability to complete tasks and reach goals). Furthermore, students' misguided sense of proficiency was likely exacerbated by their use of suboptimal cues for assessment (e.g. I was done quickly with the learning task, so I performed well), because assessments based on these cues do not necessarily offer information about *actual* performance.

Notably, only two students passed the domain-specific test. This may be a product of aforementioned overconfidence. Nowell and Alston (2007) demonstrated that students spend less time on studying if they already feel confident about the test outcome. This seems to provide a plausible explanation for the low grades among the students in our study. Likely they stopped studying prematurely, because they were instilled with a false sense of security about the test outcome. However, it has to be considered that there may have been a problem with either the learning tasks, or the domain-specific test, or both. Students' performance on the domain-specific test may have suffered from ill-alignment between the learning tasks and the domain-specific test (i.e. when the learning objectives addressed by the learning tasks do not match the learning outcomes measured in the domain-specific test).

With regard to formulation of Pfls, no change in quality was observed over the study period. Possibly, learning tasks were too small to induce deep reflection of performance on learning tasks, as was suggested by students in the interviews. Learning tasks grounded in practice (e.g. during an apprenticeship) likely would have offered more opportunities to reflect and generate meaningful, high quality Pfls.

Moreover, the leading questions that were designed to structure the reflection were perceived by the students as being too general, they did not apply to learning tasks specifically. Furthermore, students' beliefs about SDL inhibit development of their ability to formulate Pfls. Without external feedback, students think it is pointless to formulate Pfls. They think that self-assessment of performance does not provide a solid basis for formulating Pfls, because the information is inherently positively biased. Students believe you can never *really* assess your own performance. Consequently, they perceive formulation of Pfls to be of little use and do not take it seriously.

We also hypothesised an increase in students' intrinsic motivation for learning after the intervention. This increase in motivational levels was not observed. Conversely, a decrease in identified regulation was observed as well as an increase in introjected regulation and external regulation. Previous research (e.g. Pelletier et al. 2001; Vansteenkiste et al. 2004) has made a distinction between *autonomous motivation* (a combination of identified regulation and intrinsic motivation) and *controlled motivation* (a combination of external regulation and introjected regulation). For the purpose of understanding the differential effects of our intervention on students' different types of motivation for learning, we will also use this distinction. The observed increase of controlled motivation versus the observed decrease of autonomous motivation in our study is likely due to a decrease in students' perceived autonomy in the learning process. This loss of perceived autonomy is supported by qualitative results in our study: Students reported to only have worked with PERFLECT because they were required to by their teachers, and that working with PERFLECT had no educational value to them whatsoever.

4.1. Theoretical implications

Our study reinforces the importance of constructive SDL beliefs to the development of SDL skills, as suggested by previous studies (e.g. Nothnagle et al. 2011; Van Schaik, Plant, and O'Sullivan 2013). This study adds to generalizability of these findings by reporting similar findings in the context of Dutch VET. Future research is needed to determine how to best instill constructive SDL beliefs among VET students.

With respect to motivation, the reported findings seem to hold true especially for students with a practical orientation. Practically oriented students typically include VET students (e.g. car mechanics), but may also include higher

education students (e.g. registered nurses). Referencing to professional practice as a motivational strategy may be particularly meaningful to practically oriented students. For students with a more theoretical orientation (e.g. mathematicians) this motivational strategy may prove less effective, as for them often no clear professional profile exists. To understand how the design of electronic development portfolios and associated coaching might be impacted by degree of practical orientation, further research is needed.

Students' repeated exposure to learning tasks that were perceived to be too easy likely led to an increase in overconfidence. Possibly, students would have reflected less on these learning tasks if PERFLECT did not require them to. This begs the question if the use of e-portfolios can be responsible for an increase in overconfidence among students. If so, how would e-portfolios be responsible for such an increase? Further research is needed to answer the two previous questions.

Findings in this study indicate that students did not use optimal cues for performance assessment. It is important to know how portfolios should be designed so that students are encouraged to use optimal cues for performance assessment. Furthermore, this design should account for differences between various types of education. For example, between differences in focus between VET (i.e. a focus on practical skills) and higher education (i.e. a focus on deep understanding). It seems that promotion of the use of objective cues for performance assessment has the most chance of success in real-life situations for VET students. These situations are motivating to them, can provide objective cues about actual performance, and are very concrete. To investigate how portfolios should be designed to evoke the use of optimal cues for performance assessment and on how this design can be adapted to different educational contexts, future research is needed.

4.2. Practical implications

To ensure that students engage in deep reflection of performance on learning tasks they need to be aware of the need for self-improvement (Chau and Cheng 2010). In order to raise such awareness, we propose to offer students just-in-time feedback about their proficiencies and their deficiencies in their performance on learning tasks. It has to be noted that offering just-in-time feedback is most effective when mastering procedural aspects of a learning task (i.e. aspects of a learning task that are recurrent, like greeting a customer). As such a teacher needs to be present while students are executing learning tasks.

Intrinsic motivation for learning among students needs to be promoted by fostering their autonomy in the learning process. Students should be able to assess performance on learning tasks of their own choice. This allows them to assess performance on learning tasks that they feel are relevant to their own learning. However, to ensure that students choose learning tasks that fit with their learning needs and allow them to come to an accurate self-assessment they should receive feedback on their selection and tips about selecting appropriate

learning tasks. To further enhance relevancy to their learning, students should also be able to select learning tasks for assessment situated in their clerkships.

To promote PERFLECT's integration into the daily educational routine it should be able to communicate with other software that students use. We suggest using an application programming interface (API), which is a set of protocols that describe rules for communication between source software and external software. The use of an API would allow other software to communicate with PERFLECT and integrate its data and services into their own environment. As such students can use one programme to access all of their relevant data.

Students should receive enough support during the acquisition of SDL skills. PERFLECT and possibly electronic development portfolios in general should be able to take over even more routine tasks from teachers, so that they can spend additional time supporting students. The extra time should be put to use by providing more (specific) feed up, feed back and feed forward to students. Furthermore, the extra time should be spent by assuring that second-order scaffolding can occur more gradually. This likely helps to combat feelings of abandonment among students, because they assume responsibility of their learning in a slower, more supported fashion. Finally, more teacher time can also be focused on witnessing performance of learning tasks so that teachers can offer aforementioned just-in-time feedback and help create awareness for the need of improvement among students.

4.3. Limitations

This study lacked a control group. As such, it is hard to attribute the described effects on SDL and motivation to the intervention. However, the sequential mixed-methods explanatory design of the study ensured that additional data were collected. These data give credence to the fact that the reported effects are attributable to our intervention and are not a product of chance.

Due to logistical constraints it was not possible to have the coaches present during execution of the learning tasks. Thus, the coaches could not assess the actual performance of the students. However, the learning tasks also prompted students to describe their learning process. This way the coaches could assess the product of the learning task and the process. Nevertheless, it would be preferable to have coaches present during the actual execution of the learning tasks to rule out any self-reporting biases.

Our approach to SDL entails a cyclical process of self-assessment of performance, formulation of Pfls, and selection of future learning tasks. Whereas students in our study were able to self-assess their performance and formulate Pfls, they could not select future learning tasks. Not having control over selection of learning tasks may have led to reduced feelings of autonomy and reduced personal relevancy. Students should be supported in the whole SDL cycle to ensure that they learn to self-direct their learning process effectively.

4.4. Conclusion

Using an electronic development portfolio with a student self-coaching protocol and limited teacher coaching to facilitate students' development of SDL skills is a delicate process to which many conditions apply. To ensure that the development of SDL skills is facilitated optimally, students should be assisted in seeing the need for deep reflection of performance on learning tasks. To do so, it is important that they are instilled with constructive conceptions about SDL and that they receive feedback on their performance on learning tasks just-in-time. Furthermore, intrinsic motivation for learning needs to be fostered by giving students a certain degree of autonomy over the learning tasks they want to assess, while supporting them in choosing learning tasks that are appropriate for self-assessment.

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